

Strand 2: Patterns/Algebraic Thinking (Concepts and Language of Algebra, Functions and Mathematical Models)

Rationale

One of the central themes of mathematics is the study of patterns, relationships, and functions. Exploring patterns helps students develop mathematical power. Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

Purpose of the Inventory

The purpose of the Patterns and Algebraic Thinking strand of this inventory is to assist teachers in evaluating a student's ability to recognize, describe, reproduce, and extend patterns in a variety of situations. This strand indicates whether the student has an understanding of patterns in the real world.

Inventory Administration

This inventory is to be administered to students individually by the classroom teacher. Teachers will complete the student checklist while administering the Inventory.

Manipulatives and Inventory Items

These manipulatives are included in the kit and will be used during administration of this inventory:

Unifix cubes	Attribute blocks	Dry-erase board, marker, and eraser	Pattern blocks
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PAT 1

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Manipulatives

- None

Teacher says,

I am going to show you a pattern. When I am done, I want you to make the same pattern.

Teacher demonstrates the following physical pattern: 2 slaps on thighs and one clap. (repeat 3 times)

Teacher says,

Your turn.

(Answer: Student correctly repeats pattern.)

Kindergarten Standard 263.01: Understand the concept of functions.

a. Replicate and extend patterns and identify the rule (function) that creates the pattern.

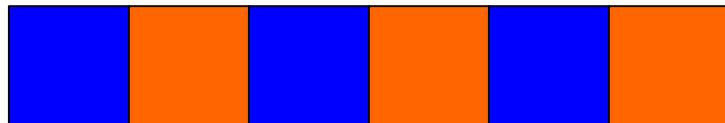
PAT 2

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Manipulatives

- Unifix cubes,
two colors

Teacher uses 6 Unifix cubes to make an ABABAB pattern. (Any two colors may be used.)



Teacher says,
Tell me about this pattern.

(Answer: Student says alternating colors shown. Listen for vocabulary: pattern, repeating, ABAB, 1212, same, etc.)

ABABAB pattern will also be used for next item.

Kindergarten Standard 263.01: Understand the concept of functions.
c. Understand and use appropriate vocabulary.

PAT 3

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Teacher gives student the ABABAB pattern from item 2. Teacher gives student a group of cubes and says,

Can you make my pattern longer?

(Answer: Student correctly continues AB pattern for at least two cubes.)

Manipulatives

- Multi-colored Unifix cubes

Kindergarten Standard 263.01: Understand the concept of functions.
a. Replicate and extend patterns and identify the rule (function) that creates the pattern.

PAT 4

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Teacher gives student attribute blocks.

Teacher says,

Sort these blocks into groups.

(Answer: Student sorts into groups.)

Manipulatives

- Attribute blocks: large triangles, large circles

Teacher says,

Tell me how you sorted the blocks.

(Answer: Accept reasonable answer. Example: color, shape, thickness, etc.)

Kindergarten Standard 258.02: Use reasoning skills to recognize problems and express them mathematically.

a. Use concrete objects to identify and show a solution to problems.

Kindergarten Standard 263.01: Understand the concept of functions.

a. Replicate and extend patterns and identify the rule (function) that creates the pattern.

PAT 5

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Manipulatives

Pattern blocks:

- 5 red trapezoids
- 3 blue rhombi
- 5 yellow hexagons
- 7 green triangles

Teacher sets out the pattern blocks (grouped by color) and points to the yellow group.

Teacher asks,

Which group of pattern blocks has less than the yellow group?

(Answer: Blue group)

Kindergarten Standard 260.01: Use algebraic symbolism as a tool to represent mathematical relationships.

a. Compare sets of objects using vocabulary (less than, greater than, same as).

1 2 1 2 1 2 1 2 1

1 2 3 1 2 3 1 2 3

1 2 2 1 2 2 1 2 2

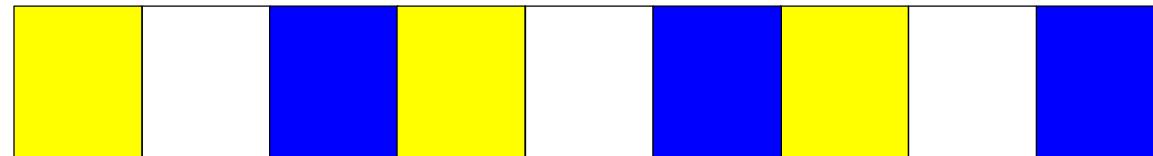
3 3 4 4 3 3 4 4 3

121212121	123123123
122122122	334433443

- Manipulatives
- Unifix cubes

Teacher provides 9 Unifix cubes in an a-b-c pattern repeated three times.

Example:



(Any three colors of Unifix cubes may be used.)

Teacher says,

This is an A-B-C pattern. Point to the number pattern on the page that uses the same pattern as the cubes.

(Answer: Student answer should indicate 1, 2, 3, 1, 2, 3, 1, 2, 3)

1st Grade Standard 273.01: Understand the concepts of functions.

a. Extend patterns and identify the rule (function) that creates the pattern.

$$2 + 2 = 4$$

$$2 + 2 + 2 = 6$$

$$2 + 2 + 2 + 2 = 8$$



Teacher refers student to number sentences.

$$2 + 2 = 4$$

$$2 + 2 + 2 = 6$$

$$2 + 2 + 2 + 2 = 8$$

Teacher asks,

If you continue this pattern, what would come next?

(Answer: Adding 2 more each time, or $2+2+2+2+2 = 10$)

Manipulatives

- None

1st Grade Standard 273.01: Understand the concept of functions.
c. Understand and use appropriate vocabulary.

$$\begin{array}{r} 5 \\ + 2 \\ \hline 7 \end{array} \qquad \begin{array}{r} 2 \\ + 5 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 5 \\ + 2 \\ \hline 7 \end{array} \qquad \begin{array}{r} 2 \\ + 5 \\ \hline 7 \end{array}$$

Teacher points to the problems on student page.

Teacher asks,

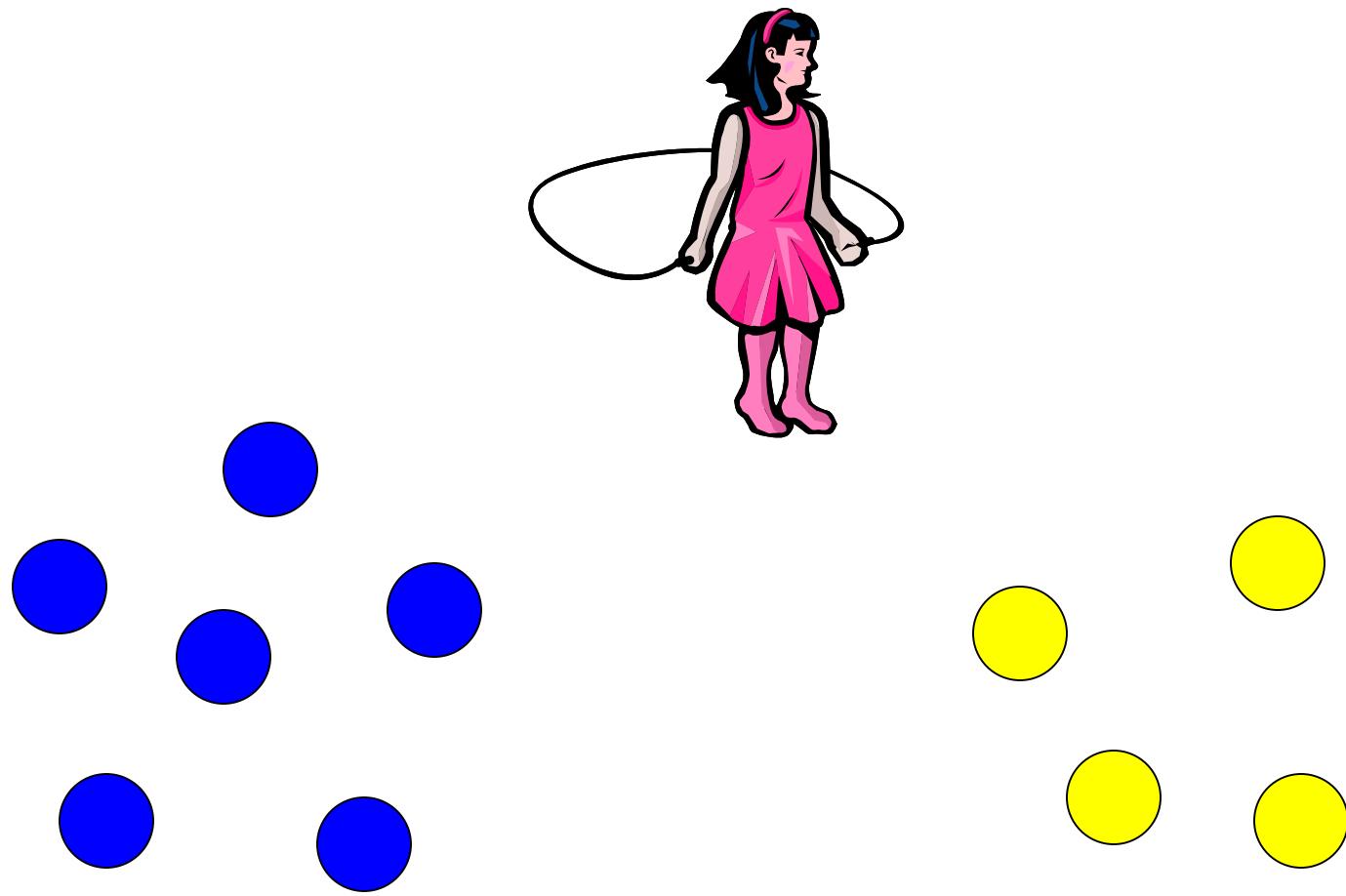
Tell me why the sums of these two addition problems are the same?

(Answer: Accept reasonable answer. Examples: turn around fact, opposites, fact family.)

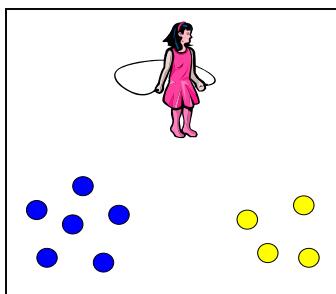
Manipulatives

- None

1st Grade Standard 270.02: Evaluate algebraic expressions.
a. Explore and use the commutative property of addition.



PAT 9



Manipulatives

- Dry-erase board
- Dry-erase marker

Teacher provides dry-erase board and marker.

Teacher says,

Sally has blue and yellow m&m's. Write a number sentence that shows how many m&m's are left if Sally eats all the yellow m&m's.

(Answer: $10 - 4 = 6$)

1st Grade Standard 268.01: Understand and use a variety of problem-solving skills.

a. Select strategies appropriate to solve a problem.

1st Grade Standard 268.04: Communicate results using appropriate terminology and methods.

b. Use appropriate vocabulary to communicate mathematical reasoning.

1st Grade Standard 270.01: Use algebraic symbolism as a tool to represent mathematical relationships.

b. Write a number sentence given an addition or subtraction problem.

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Teacher says,

1. Tell me a number that is greater than 25.

(Answer: Accept any answer that is greater than 25.)

2. Tell me a number that is less than 25.

(Answer: Accept any answer that is less than 25.)

Manipulatives

- None

1st Grade Standard 270.01: Use algebraic symbolism as a tool to represent mathematical relationships.

c. Compare numbers using vocabulary

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Manipulatives

- Attribute blocks: large triangles, large circles, large hexagons

Teacher sets all attribute blocks in front of student (randomly).

1. Teacher says, **Please sort these into groups.**

(Answer: Student sorts into groups.)

2. Teacher says, **Tell me how you sorted.**

(Answer: Accept reasonable answer. Example: color, shape, thickness, etc.)

Teacher removes all but one of the student's groups.

3. Teacher says, **Now sort this group.**

(Answer: Student sorts into group.)

4. Teacher says, **Tell me how you sorted.**

(Answer: Accept reasonable answer. Example: color, shape, thickness, etc.)

1st Grade Standard 273.01: Understand the concept of functions.

b. Sort and classify objects by more than one attribute.

29, 31, 33, ___, ___, 39, 41, ___, ___

29, 31, 33, ___, ___, 39, 41, ___, ___

Teacher points to the row of numbers on the flip chart.

Teacher asks,

What are the missing numbers?

(Answer: 35, 37, 43, 45)

Manipulatives

- None

2nd Grade Standard – 283.01: Understand the concept of functions.

a. Extend patterns and identify the rule (function) that creates the pattern.

A. If $12 + 3 = 15$

$$15 - \boxed{} = 12$$

B. If $8 + 7 = 15$

$$7 + 8 = \boxed{}$$

A. If $12 + 3 = 15$
 $15 - \square = 12$

B. If $8 + 7 = 15$
 $7 + 8 = \square$

Teacher provides dry-erase board and marker for scratch work. Refer student to problems A and B.

Teacher says,
Solve these problems.

Manipulatives

- Dry-erase board
- Dry-erase marker

(Answer: A=3, B=15)

2nd Grade Standard 280.01: Use algebraic symbolism as a tool to represent mathematical relationships.

d. Understand the relationship between addition and subtraction and demonstrate reversal of operations.

If you have 7 balloons in one hand and 5 in the other hand,
how many balloons do you have all together?

If you have 7 balloons in one hand and 5 in the other hand, how many balloons do you have all together?

Manipulatives

- Dry-erase board
- Dry-erase marker

Teacher gives the student the dry-erase board and marker.

Teacher reads,

If you have 7 balloons in one hand and 5 in the other hand, how many balloons do you have all together? Write a number sentence that explains how you solved the problem.

(Answer: Student should write an appropriate number sentence.)

2nd Grade Standard 278.02: Use reasoning skills to recognize problems and express them mathematically.

a. Generate a number sentence from a problem-solving situation.

2nd Grade Standard 280.01: Use algebraic symbolism as a tool to represent mathematical relationships.

b. Write a number sentence given an addition or subtraction problem.

If you have 12 balloons and
2 balloons fly away, how
many balloons are left?

If you have 12 balloons and 2 balloons fly away, how many balloons are left?

Manipulatives

- None

Teacher gives the student the dry-erase board and marker.

Teacher reads,

If you have 12 balloons and 2 balloons fly away, how many balloons are left? Write a number sentence to explain how you solved this problem.

(Answer: Student should write an appropriate number sentence to show how he/she solved the problem.)

2nd Grade Standard 278.02: Use reasoning skills to recognize problems and express them mathematically.

a. Generate a number sentence from a problem-solving situation.

2nd Grade Standard 280.01: Use algebraic symbolism as a tool to represent mathematical relationships.

b. Write a number sentence given an addition or subtraction problem.

(A)

$$46 \quad \boxed{} \quad 64$$

(B)

$$83 \quad \boxed{} \quad 79$$

(C)

$$367 \quad \boxed{} \quad 367$$

>

<

+

=

- | | | | |
|----|-----|--------------------------|-----|
| A. | 46 | <input type="checkbox"/> | 64 |
| B. | 83 | <input type="checkbox"/> | 79 |
| C. | 367 | <input type="checkbox"/> | 367 |
| > | < | + | = |

Manipulatives

- None

Refer student to items A-C on the flip chart.

Teacher says,

Point to the symbol at the bottom of the page
that goes in the box.

Teacher points to boxes A, B, and C one at a time and waits for the student to respond.

(Answer: A. < B. > C. =)

2nd Grade Standard 278.04: Communicate results using appropriate terminology and methods.

a. Use a variety of methods such as words, numbers, symbols, charts, graphs, tables, diagrams, and models to communicate mathematical information.

2nd Grade Standard 280.01: Use algebraic symbolism as a tool to represent mathematical relationships.

c. Compare numbers using vocabulary (less than, greater than, equal to) and symbols (<,>,=).

